



Surname \_\_\_\_\_

Forename(s) \_\_\_\_\_

Centre Number \_\_\_\_\_

Candidate Number \_\_\_\_\_

Candidate Signature \_\_\_\_\_

I declare this is my own work.

**GCSE**

**COMBINED SCIENCE: TRILOGY**

Foundation Tier

Chemistry Paper 2F

**F**

**8464/C/2F**

**Tuesday 11 June 2024**

**Morning**

**Time allowed: 1 hour 15 minutes**

**[Turn over]**



J U N 2 4 8 4 6 4 C 2 F 0 1

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**On the front of this book, write your surname and forename(s), your centre number, your candidate number and add your signature.**

## **MATERIALS**

**For this paper you must have:**

- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed).**

**[Turn over]**



## INSTRUCTIONS

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Answer ALL questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.



**INFORMATION**

- **The maximum mark for this paper is 70.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

**DO NOT TURN OVER UNTIL TOLD TO DO SO**



0	1
---	---

**The Earth's atmosphere has changed during the last 4.6 billion years.**

0	1	.	1
---	---	---	---

**What is the approximate percentage of nitrogen and of oxygen in the Earth's atmosphere today?**

**On the opposite page, draw ONE line from each gas to the percentage of that gas. [2 marks]**



**GAS**

**PERCENTAGE (%)  
OF GAS**

**Nitrogen**

**20**

**40**

**Oxygen**

**60**

**80**

**[Turn over]**



0	1	.	2
---	---	---	---

The approximate percentage of carbon dioxide in the Earth's early atmosphere was 95%.

Which are TWO reasons why the percentage of carbon dioxide has **DECREASED** since the Earth's early atmosphere? [2 marks]

Tick (✓) TWO boxes.

**Combustion of fuels**

**Deforestation**

**Dissolving in oceans**

**Photosynthesis**

**Respiration**



0	1	.	3
---	---	---	---

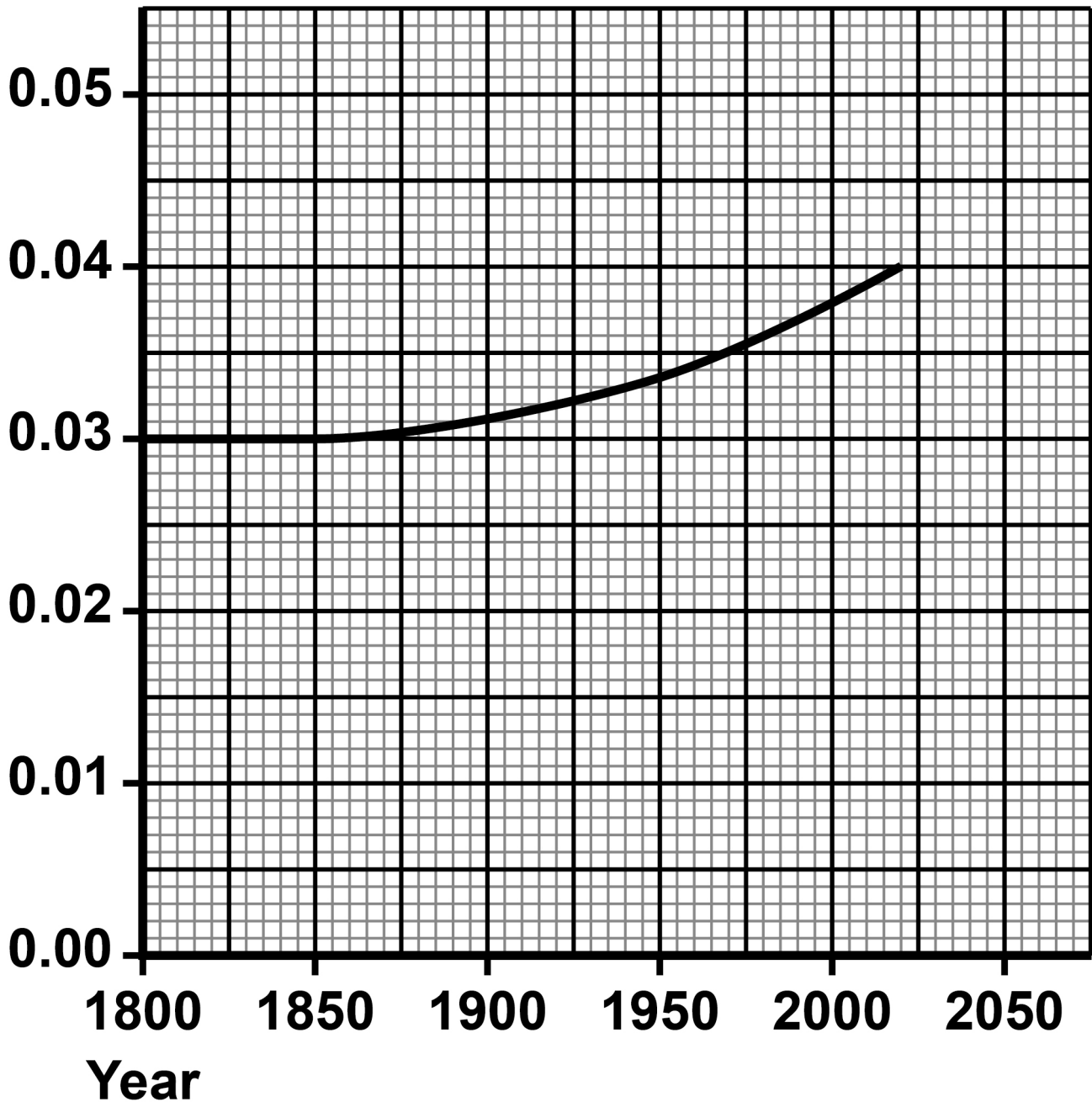
**FIGURE 1, on page 10, shows the change in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.**

**[Turn over]**



**FIGURE 1**

**Percentage (%) of carbon dioxide in  
the Earth's atmosphere**





**Carbon dioxide is a greenhouse gas.**

**0 1 . 4**

**Which of the following is also a greenhouse gas? [1 mark]**

**Tick (✓) ONE box.**

**Argon**

**Methane**

**Nitrogen**

**Oxygen**



0	1	.	5
---	---	---	---

**Which of the following is an environmental problem caused by greenhouse gases? [1 mark]**

**Tick (✓) ONE box.**

**Acid rain**

**Climate change**

**Global dimming**

**[Turn over]**



0	1	.	6
---	---	---	---

Calculate the relative formula mass ( $M_r$ ) of carbon dioxide ( $\text{CO}_2$ ).

Relative atomic masses ( $A_r$ ):

C = 12      O = 16

[2 marks]

---

---

---

---

---

---

Relative formula mass of carbon dioxide =

---

11



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**[Turn over]**



0 2

Different tests can be used to identify chemicals.

0 2 . 1

A student measured the melting points of four substances.

TABLE 1 shows the results.

TABLE 1

SUBSTANCE	MELTING POINT IN °C
A	52 to 54
B	61
C	-2 to 0
D	80 to 82



**Which substance was pure?**

**Give ONE reason for your answer.**

**[2 marks]**

**Substance** \_\_\_\_\_

**Reason** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[Turn over]**





**Anhydrous copper sulfate can be used to test for water.**

**The word equation for the reaction is:**

**anhydrous copper sulfate + water  $\rightleftharpoons$  hydrated copper sulfate**

**0 2 . 2**

**Complete the sentence on the opposite page.**

**Choose answers from the list. [2 marks]**

- **blue**
- **green**
- **red**
- **white**
- **yellow**



When water is added to anhydrous copper sulfate, the colour changes from \_\_\_\_\_ to \_\_\_\_\_.

0 2 . 3

The reaction between anhydrous copper sulfate and water is reversible.

How does the word equation show that the reaction is reversible? [1 mark]

---

[Turn over]

0	2	.	4
---	---	---	---

The formula of anhydrous copper sulfate is  $\text{CuSO}_4$

What is the total number of atoms in the formula  $\text{CuSO}_4$ ? [1 mark]

Tick (✓) ONE box.

3

4

6

7



0 2 . 5

Chlorine is a gas.

Describe the test for chlorine.

Give the result. [2 marks]

Test \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Result \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

[Turn over]

8



0	3
---	---

**Printer ink is a mixture of chemicals.**

0	3	.	1
---	---	---	---

**What is the name given to a mixture that has been designed as a useful product?  
[1 mark]**

**Tick (✓) ONE box.**

**Formula**

**Formulation**

**Fraction**



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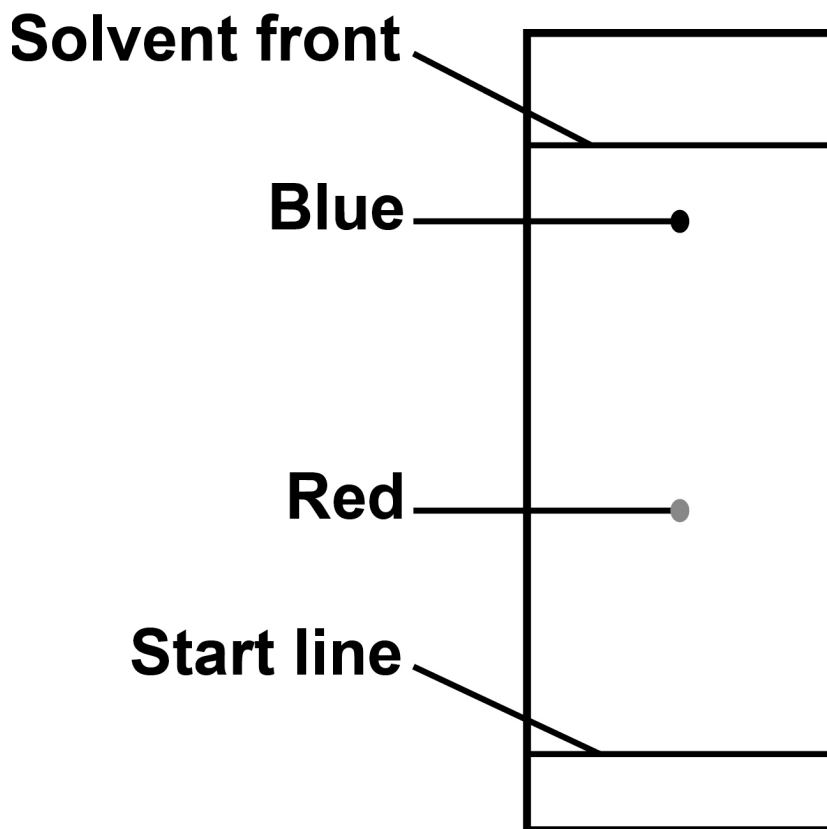
**[Turn over]**



A student used chromatography to investigate the colours in a printer ink.

FIGURE 2 shows the chromatogram.

FIGURE 2



0 3 . 2

The student used a ruler for the start line.

What would the student have used to draw the start line?

Give ONE reason for your answer.  
[2 marks]

---

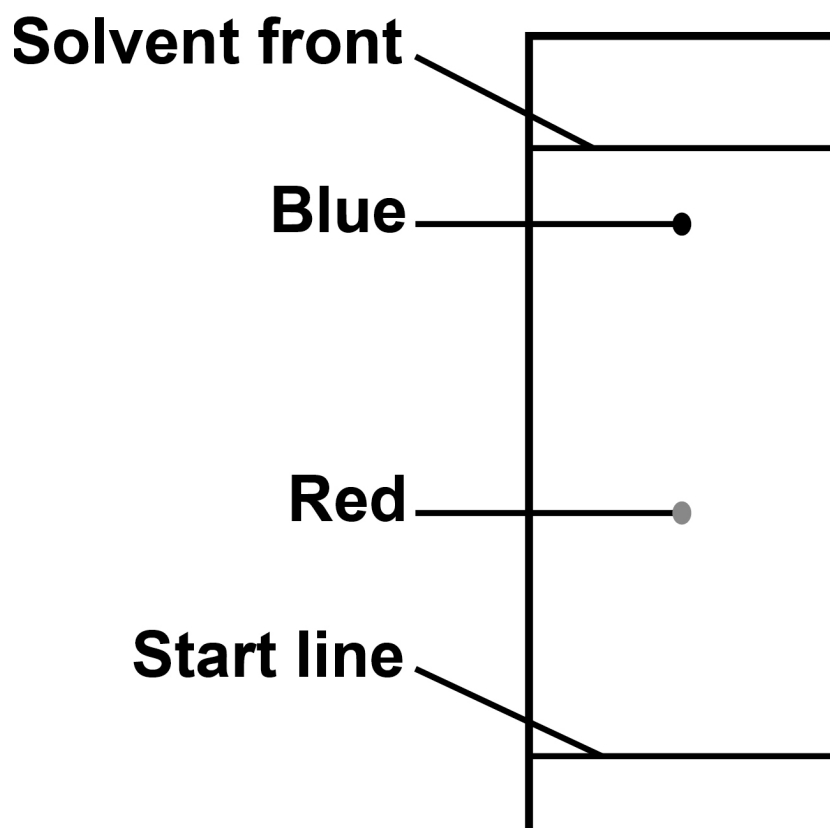
Reason \_\_\_\_\_

---

---

[Turn over]

## REPEAT OF FIGURE 2



0	3	.	3
---	---	---	---

Determine the  $R_f$  value of the RED colour.

Use the equation:

$$R_f = \frac{\text{distance moved by colour}}{\text{distance moved by solvent}}$$

[4 marks]



**Distance moved by red colour**

---

**Distance moved by solvent**

---

---

---

---

---

**$R_f =$**  \_\_\_\_\_

**[Turn over]**



0	3	.	4
---	---	---	---

**TABLE 2** shows the  $R_f$  values of four blue colours.

**TABLE 2**

<b>BLUE COLOUR</b>	<b><math>R_f</math></b>
<b>Cerulean</b>	<b>0.40</b>
<b>Cobalt</b>	<b>0.15</b>
<b>Prussian</b>	<b>0.88</b>
<b>Ultramarine</b>	<b>0.68</b>



The student determined that the  $R_f$  value of the blue colour in the printer ink was 0.86

Suggest which blue colour was used in the printer ink.

Give ONE reason for your answer.  
[2 marks]

Blue colour \_\_\_\_\_

Reason \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

[Turn over]

9



0	4
---	---

**Tap water must be safe to drink.**

0	4	.	1
---	---	---	---

**What name is given to water that is safe to drink? [1 mark]**

**Tick (✓) ONE box.**

**Ground water**

**Potable water**

**Waste water**



0	4	.	2
---	---	---	---

**Water is sterilised to make the water safe to drink.**

**Which TWO of the following are used to sterilise drinking water? [2 marks]**

**Tick (✓) TWO boxes.**

**Carbon dioxide**

**Electrolysis**

**Filtration**

**Ozone**

**Ultraviolet light**

**[Turn over]**



**A student investigated the mass of dissolved solids in samples of river water, sea water and tap water.**

**This is the method used.**

- 1. Weigh an evaporating basin.**
- 2. Measure 100 cm<sup>3</sup> of river water.**
- 3. Pour the river water into the evaporating basin.**
- 4. Heat the evaporating basin until all the water has evaporated.**
- 5. Weigh the evaporating basin and dissolved solids.**
- 6. Calculate the mass of dissolved solids in the water.**
- 7. Repeat steps 1 to 6 with sea water and then with tap water.**



0	4	.	3
---	---	---	---

**Which is the most suitable equipment to measure 100 cm<sup>3</sup> of water? [1 mark]**

**Tick (✓) ONE box.**

**Beaker**

**Conical flask**

**Measuring cylinder**

**[Turn over]**





0 4 . 4

TABLE 3 shows the results.

TABLE 3

TYPE OF WATER	MASS IN GRAMS		
	Evaporating basin	Evaporating basin and dissolved solids	Dissolved solids
River	112.1	113.1	1.0
Sea	110.5	114.0	X
Tap	115.3	115.4	0.1



**Calculate value X in TABLE 3. [1 mark]**

---

---

**X = \_\_\_\_\_ g**

**[Turn over]**

0	4	.	5
---	---	---	---

**Identify the variables used in the investigation.**

**On the opposite page, draw ONE line from each variable to the example of the variable. [2 marks]**



**VARIABLE**

**EXAMPLE OF  
VARIABLE**

**Control**

**Mass of  
dissolved solids**

**Mass of  
evaporating basin**

**Dependent**

**Room  
temperature**

**Type of water**

**Volume of water**

**[Turn over]**



**TABLE 4** shows the mass of different types of ions dissolved in  $1 \text{ dm}^3$  of sea water.

**TABLE 4**

<b>TYPE OF ION</b>	<b>MASS OF TYPE OF ION DISSOLVED IN <math>1 \text{ dm}^3</math> OF SEA WATER IN GRAMS</b>
<b>Calcium</b>	<b>0.4</b>
<b>Magnesium</b>	<b>1.3</b>
<b>Sulfate</b>	<b>2.7</b>

**0 4 . 6**

**Complete FIGURE 3, on the opposite page.**

**You should:**

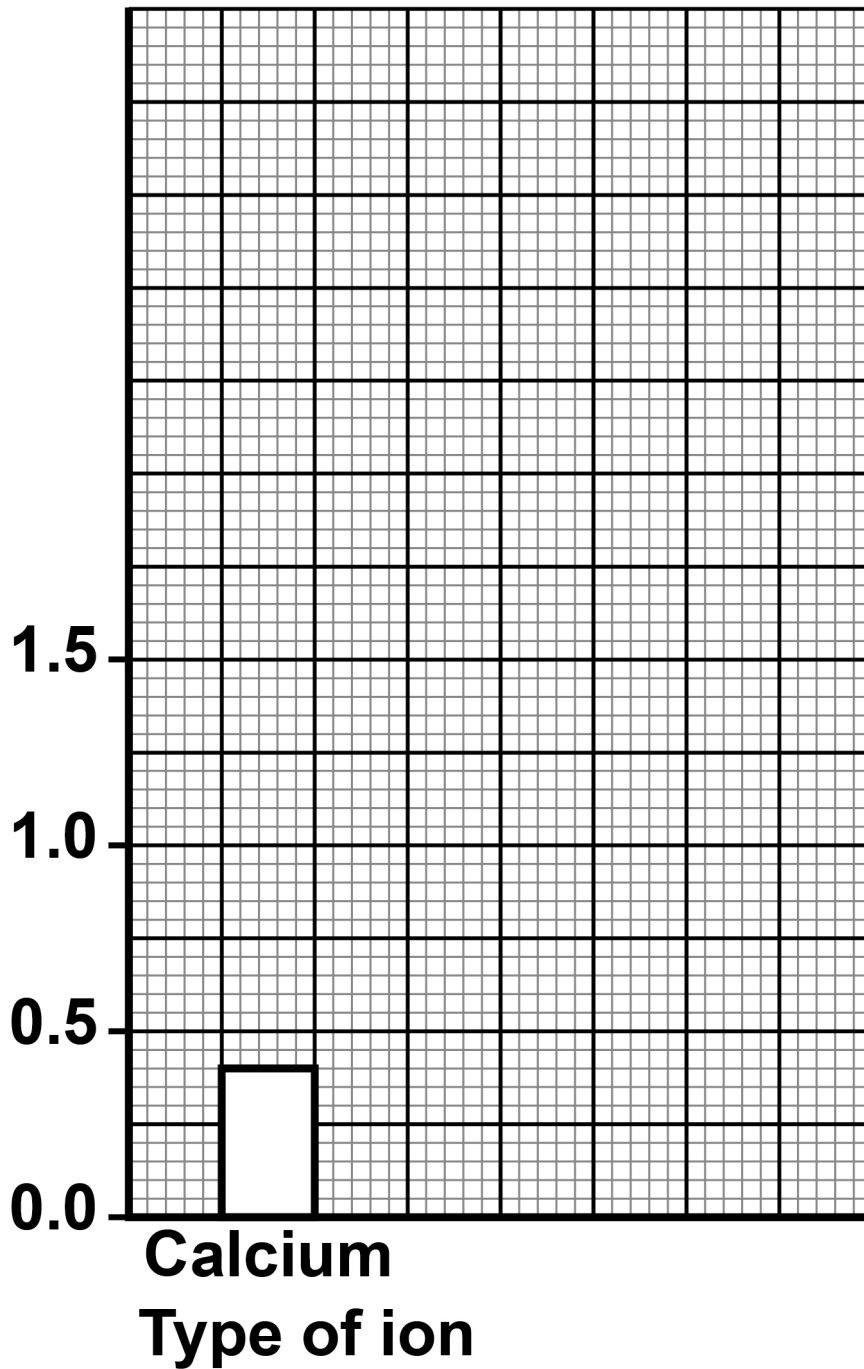
- **complete the scale for the  $y$ -axis**
- **plot the data from TABLE 4 as a bar chart.**

**[3 marks]**



**FIGURE 3**

**Mass of ion dissolved in  
1 dm<sup>3</sup> of sea water in grams**



**[Turn over]**



0	5
---	---

**Life cycle assessments (LCAs) are used to assess the environmental impact of different products.**

0	5	.	1
---	---	---	---

**212 million kilograms of aluminium is used for packaging in the UK each year.**

**68.0% of aluminium packaging is recycled.**

**Calculate the mass of aluminium packaging that is recycled in the UK each year. [2 marks]**

---

---

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---

---

**Mass of aluminium recycled =**  

---

\_\_\_\_\_ **million kg**

**[Turn over]**



0	5	.	2
---	---	---	---

**Drinks cans are made from aluminium.**



**An image shows a collection of open aluminium drinks cans.**

**An aluminium can has a mass of 15.8 g.**

**1000 g = 1 kg**





0 5 . 3

**TABLE 5** shows three methods used to dispose of wood and steel after use.

**TABLE 5**

<b>PERCENTAGE (%) OF MATERIAL DISPOSED OF BY EACH METHOD</b>			
	<b>AS WASTE</b>	<b>RECYCLED</b>	<b>BURNT</b>
<b>WOOD</b>	58	36	6
<b>STEEL</b>	15	85	0

**Evaluate the sustainability of the disposal of wood and steel. [4 marks]**

---



---



---





0	6
---	---

**Alkanes and alkenes are hydrocarbons.**

0	6	.	1
---	---	---	---

**Define the term 'hydrocarbon'. [1 mark]**

---

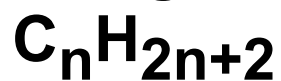
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0	6	.	2
---	---	---	---

The general formula for alkanes is



Determine the formula of the alkane with 10 carbon atoms. [1 mark]

---

---

Formula = \_\_\_\_\_

[Turn over]

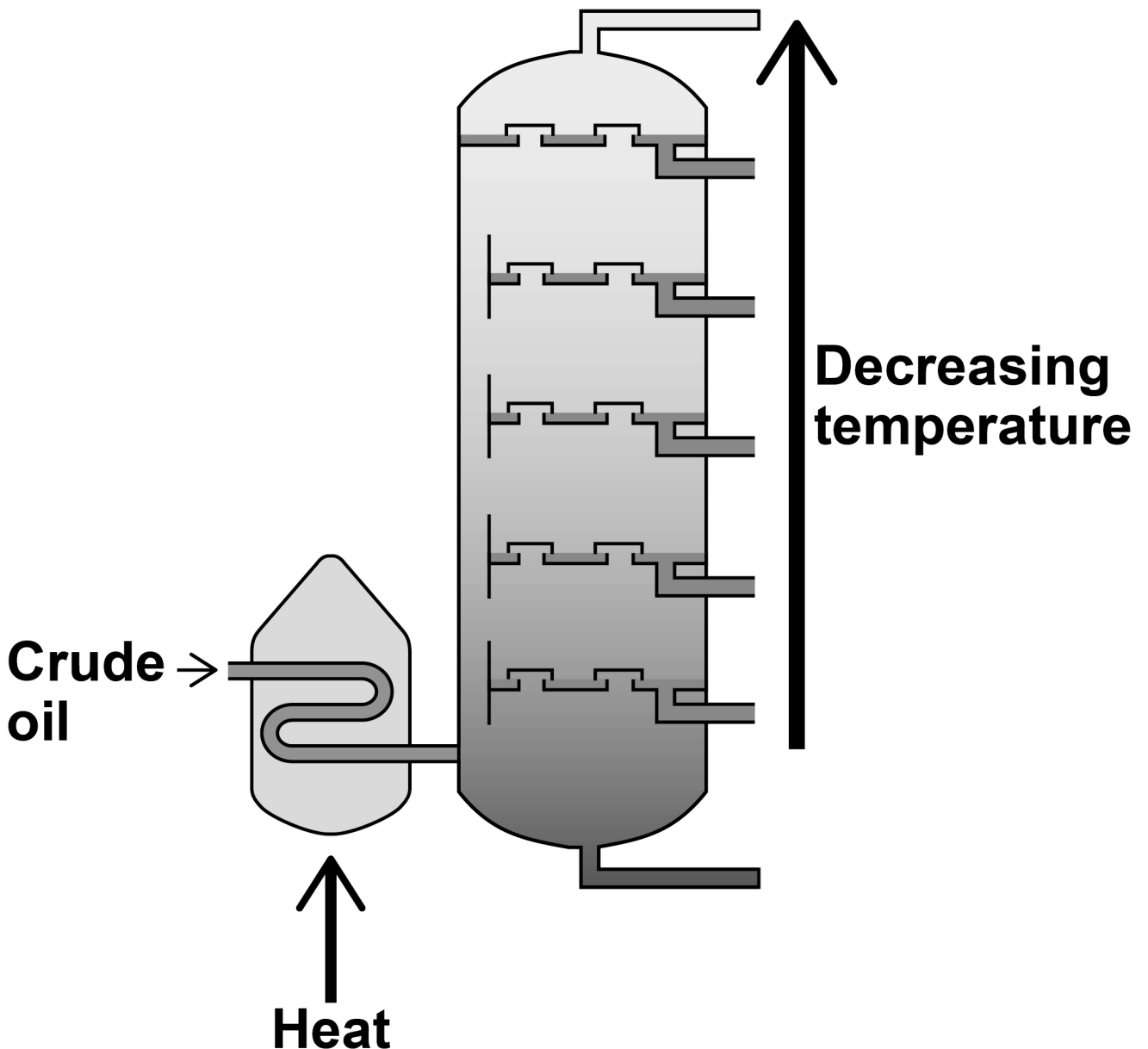


0	6	.	3
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Crude oil is a mixture of hydrocarbons.

**FIGURE 4** represents industrial equipment used to separate crude oil into fractions.

**FIGURE 4**

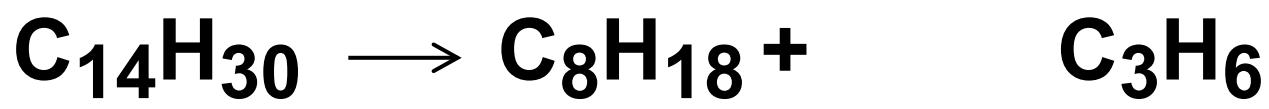




0	6	.	4
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The alkane molecule  $C_{14}H_{30}$  can be cracked to produce smaller molecules.

Balance the equation for the reaction.  
[1 mark]



Propene ( $C_3H_6$ ) is an alkene.

0 6 . 5

Describe the test for alkenes.

Give the result. [2 marks]

Test

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Result

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[Turn over]

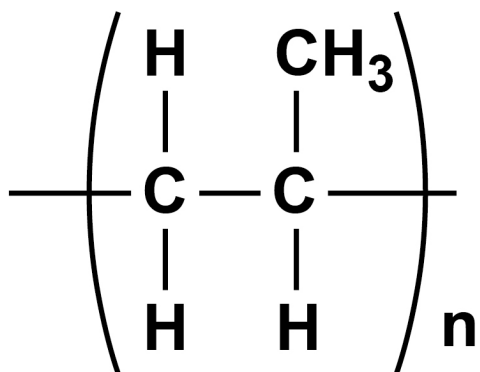


0 6 . 6

Poly(propene) is made from propene.

FIGURE 5 represents the repeating unit of poly(propene).

FIGURE 5



What type of substance is poly(propene)?  
[1 mark]

---



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10
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0	7
---	---

**Some factors affect the rates of chemical reactions.**

0	7	.	1
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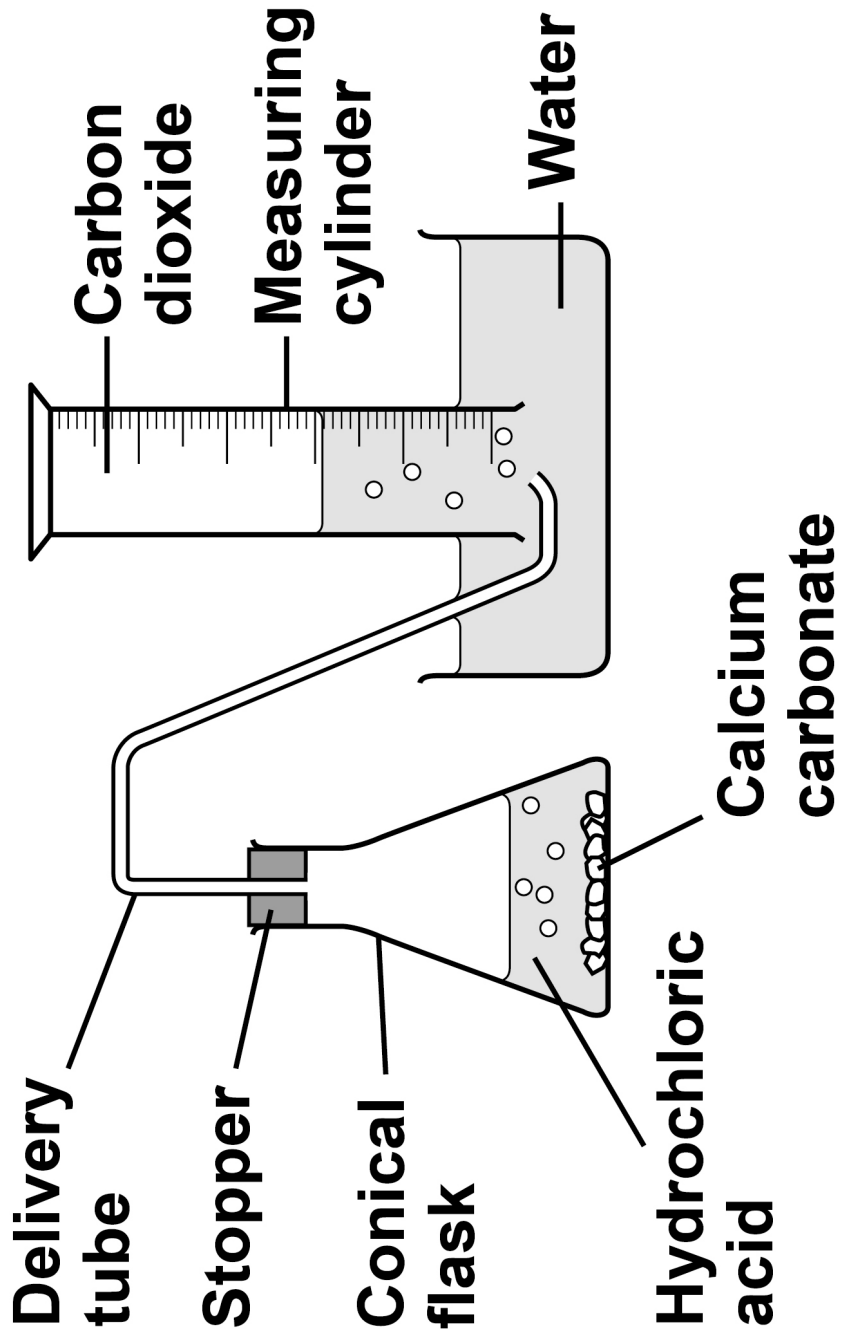
**A student investigated the effect of changing the particle size of calcium carbonate on the rate of reaction with hydrochloric acid.**

**FIGURE 6, on page 54, shows the apparatus.**

**[Turn over]**



**FIGURE 6**





**Describe a method the student could use to produce valid results. [6 marks]**

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**[Turn over]**

Vertical lines for writing or drawing.



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**[Turn over]**



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**Catalysts affect the rate of reactions.**

**0 7 . 3**

**What is meant by a 'catalyst'? [2 marks]**

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**[Turn over]**



0	7	.	4
---	---	---	---

**What are catalysts in biological systems called? [1 mark]**

---

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**END OF QUESTIONS**

12









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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
<b>TOTAL</b>	

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